

Background material for presentation on Food Habits and Diets

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Status of ecosystem data

Long term data sets exist for a suite of economically relevant groundfish species (e.g. walleye pollock, Pacific cod). More recently, a more holistic view of integrated research has prompted the inclusion of diet collection across predator functional groups. Collections now span both commercial and non-commercial fishes, multiple age classes within fish species, marine mammals, and sea birds. Many of these collections stretch back to the early 80's. Analytical integration with concurrent lower trophic level information collection (primary and secondary production) lends itself to ecosystem based fisheries management via increased food web modeling capacity via mass balance, dynamic food web, and the FEAST model.

Examples

In addition to fish diet data, the zooplankton data collected during the Bering Aleutian Salmon International Survey for age-0 walleye pollock (Coyle et al., 2011) was influential in developing and refining the leading hypothesis for an ecosystem level mechanism (Hunt et al, 2011; Oscillating Control Hypothesis) that controls production and energy flow in the southeastern Bering Sea. This same survey, along with extension into the northern Bering Sea, generated a recent publication (Andrews et al., 2015) documenting shifts in distribution and dietary patterns in abundant forage fishes. Developing an understanding of how primary and secondary production shape prey fields for forage fishes and higher trophic levels will allow us to make better predictions for changes in distribution and abundance of species targeted or relevant to commercial or subsistence harvests. In data poor circumstances, diet information can be used as a proxy for abundance. Scientists have a hard time catching octopus in research trawl nets and other fishing gear. This makes it challenging to determine the size of octopus populations in the ocean and determine how well they are doing. In the Bering Sea/Aleutian Islands, Pacific cod consistently eat octopus. By looking at cod stomachs from this area over 30 years, scientists have been able to estimate production and mortality rates of octopus and determine precautionary fishing limits for octopus in the region.

Strategies to obtain and manage ecosystem data

Diet data is collected opportunistically across a multitude of research cruises and cooperative research efforts consisting of, but not limited to: the Alaska Fisheries Science Center, the University of Washington, and the University of Alaska. Most notably, AFSC bottom trawl survey, MACE acoustic surveys, EMA summer/early fall surface trawl surveys, and FOCI spring larval surveys. These surveys span from the southern Gulf of Alaska through the Arctic.

Inclusion of ecosystem data into living marine resource management advice, and how was this inclusion decided?

Stock assessment and fishery evaluation reports typically include both predator and prey information as supporting ecosystem level production notes. This is true for walleye pollock, Pacific cod, Pacific Ocean perch, sablefish, northern rock sole, and others. The Alaska Marine Ecosystem Considerations assessments and report cards are produced annually. These include ecosystem based indicators of production. Included are indicators that relate to food habits and diet via both common predator and prey biomass and or abundance. These indicators span most large marine ecosystems in Alaska, and a just beginning in others (e.g Arctic). The Groundfish Plan Team has discussed forage patterns both in commercially targeted species, but also of potential predators of commercial species. One notable occurrence is the ESA listed Stellar Sea Lion. In the BSAI fishery for pollock, sea lions have been considered, as pollock are food item. The Groundfish Plan Team has to consider food web effects of fisheries, and how they might introduce competition with local wildlife.

Peer-review of ecosystem-related science program and products

Internal peer review is part of the process at the Alaska Fisheries Science Center. Periodically, methods are reviewed across groups to cross check and validate methods. Multiple approaches can and are used to evaluate food habits and diet data in marine ecosystems. Some are aimed at very fine scale detail, some are aimed at modeling efforts, and others attempt to quickly capture gross response to environmentally driven patterns in prey communities. These reviews typically occur at the Recruitment Processes Alliance meeting. Many of the results from these studies are published in peer reviewed journal articles. The Alaska Fisheries Science Center publication database contains 235 records with the word 'diet' in the title, 235 records with the word 'food' in the title, 105 records with the word 'prey', 59 records with the word 'predator', and 20 records containing the word 'cannibal'. These publications span from the early 1970's (pre-AFSC) through 2016 and include, but are not limited to: abstracts, tech memos, books, journal articles, processed reports, and featured quarterly articles.

Communication to managers, partners, stakeholders and the public

Research is shared internally with quarterly reports, semi-annual Recruitment Process Alliance meetings, oral and poster presentations at large fisheries and oceanography conferences, breakout sessions at these conferences, the Groundfish Plan Team meetings, outreach events, radio interviews, and personal communication to members of the public. Most recently (March 28th, 2016), NOAA Fisheries officially rolled out two new databases that make it easy to access comprehensive, long-term diet data for key Alaska marine fish species and to track ecosystem trends for four large marine ecosystems that surround Alaska. The Resource Ecology and Ecosystem Modeling Groundfish Diet Data Tool includes a database of every prey type found in the stomach of key marine fish species – over 1 million records of individual predator/prey

interactions – caught during NOAA research surveys in Alaska waters. For some species, these data date back to the early 1980s.